Esthetic Restorations

Composite Resins

- Applied mostly to anterior teeth.
- Not as strong as amalgams, but is designed to meet the esthetic needs of a specific area.
- Needs to withstand the oral cavity environment, be easily shaped to the tooth anatomy, match well with the natural tooth, and bond directly to the tooth surface.

Composite Resins Components

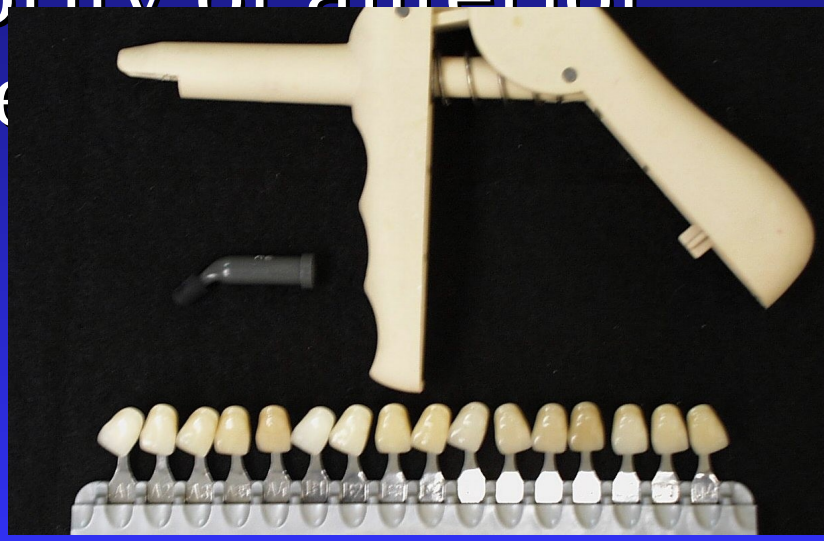
- Resin Matrix: Dimethacrylate (BIS-GMA) to provide bonding to enamel and dentin.
- Filler: quartz, glass, and silica of various sizes to provide strength and esthetically reflect light.
- Coupling Agent: organosilane compound to chemically bond resin matrix to filler.
- Photo Initiator and Amine Activator: to polymerize and harden the restoration.

Composite Resins Components

- Fillers will determine composite properties:
  - Microfill composites have very small particles, providing highly polished and smooth restoration, though not a very strong restoration.
  - Macrofill composites have large particles, providing high strength but poor esthetics.
  - Hybrid composites contain microfill and macrofill particles, providing strength, high wear resistance, and excellent shade characteristics.

Composite Resins
Herculite

- A Hybrid Composite
- An excellent product with high strength and excellent esthetics.
- Used for the majority of anterior restorations in the



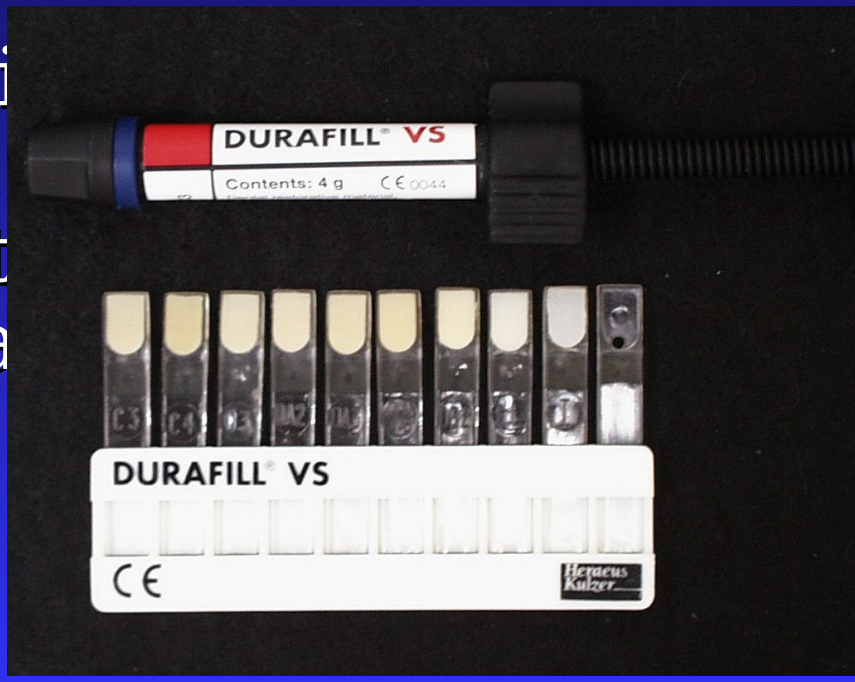
Composite Resins
Vitalescence

- A Micro-Hybrid Composite.
- Contains large number of shades for very esthetic restorations.
- Used for high
  esthetic
  restoration

Composite Resins

Durafill VS

- A Microfill Composite
- A highly polishable restoration used where strength is not of paramount importance.
- For Class V restorati
  where esthetic is
  extremely important
  and for diastema
  closures.



Composite restorations

Parameters Affecting Adhesion to Tooth Structure

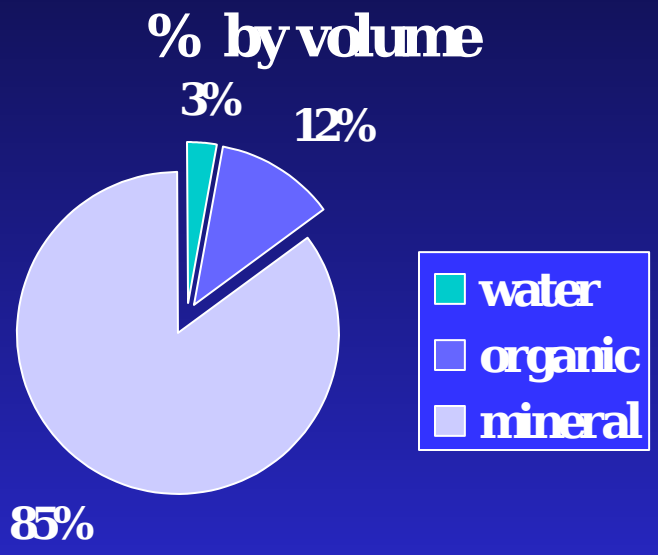
- All bonding agents are technique sensitive -
- follow all manufacturer's instructions

Enamel and Dentin Adhesion

Enamel and Dentin Adhesion

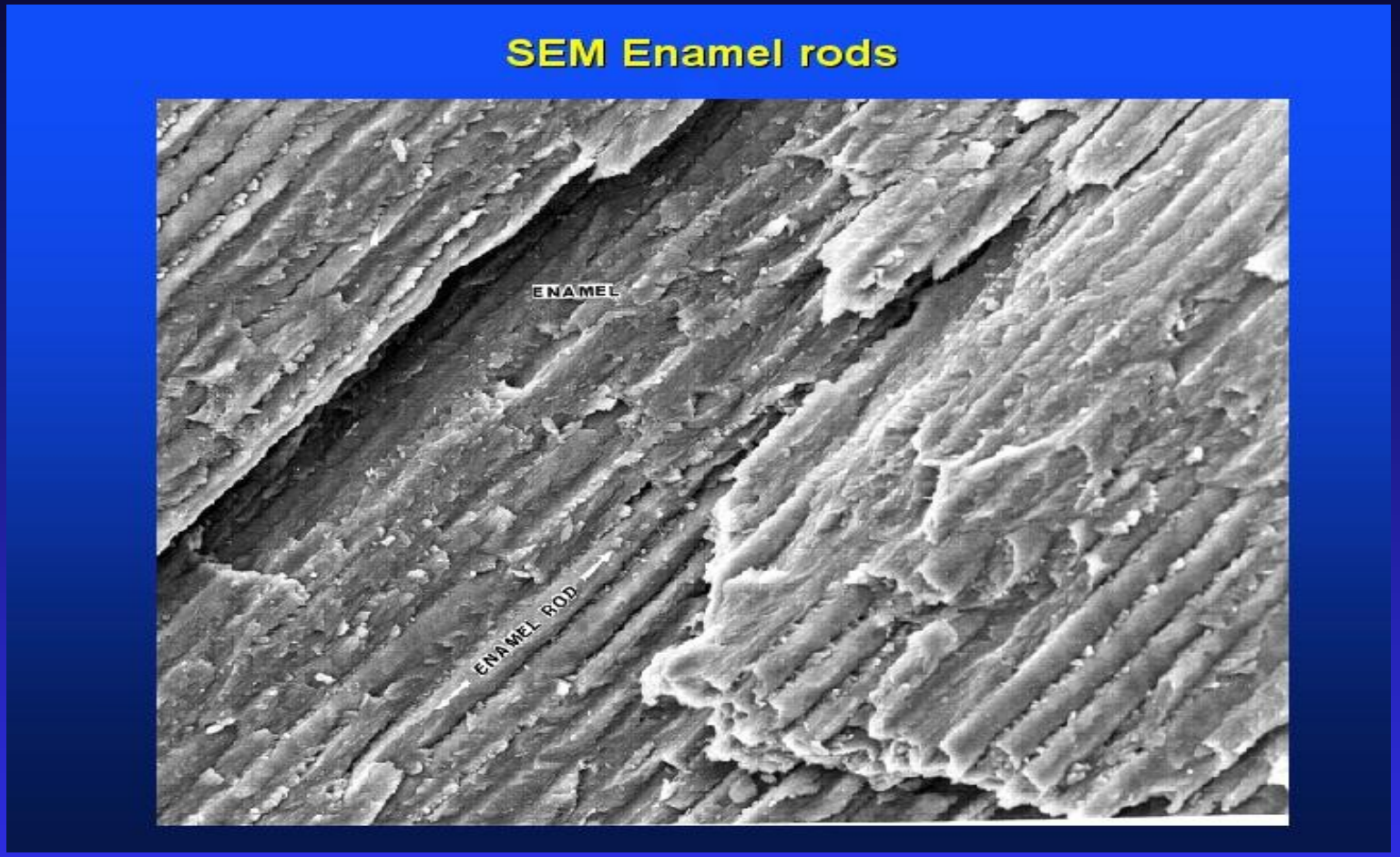
Microstructure of Teeth

Enamel



- Inorganic component is homogenous, regular rods and prisms

Enamel



Enamel and Dentin Adhesion

Adhesion to Enamel

- Enamel etching creates an irregular, high free-energy surface
- Unfilled, low viscosity resin drawn into the microporosities by capillary action
  - HEMA and/or TEG-DMA+
  - bis-GMA and/or UDMA

Enamel and Dentin Adhesion

Adhesion to Enamel

- Acid etching removes approx 10 microns of enamel

- Creates microporous layer 5-50 microns

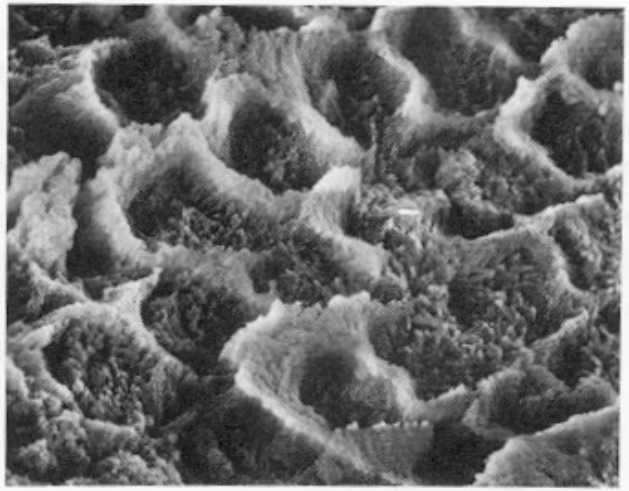


Fig. 2-1 Scanning electron micrograph (×5000) of phosphoric acid-etched enamel surface. *(Courtesy Dr. A. J. Gwinnett, State University of New York at Stony Brook.)*

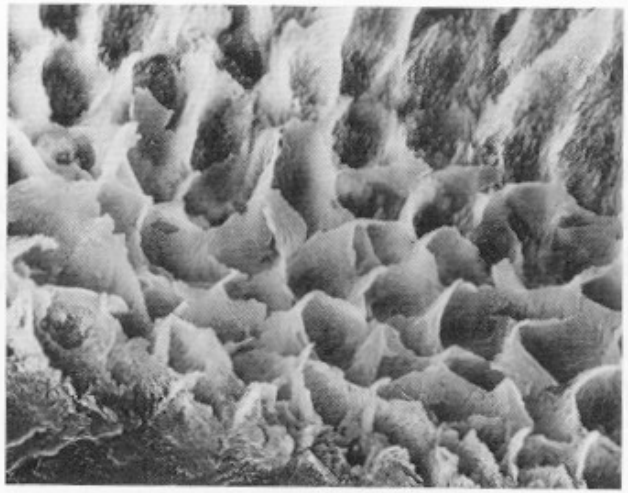


Fig. 2-2 Scanning electron micrograph (×1800) of resin tags. *(Courtesy Dr. A. J. Gwinnett, State University of New York at Stony Brook.)*

Enamel and Dentin Adhesion

Contamination

- Handpiece oil
  - preps must be cleaned with alcohol or other solvent
- Sulcular fluid
  - if allowed to contact the bonded surfaces = catastrophic failure
  - must re-etch for 15 seconds, rinse, and rebond

Albers, HR, Tooth-Colored Restoratives, 1996

Enamel and Dentin Adhesion

Contamination (cont)

- Hemorrhage
- contact with bonding surface = <u>catastrophic failure</u>
- must stop hemorrhage, clean area, re-etch for 15 seconds, rinse, and repeat last bonding step

Albers, HR; Tooth-Colored Restorations, 1996

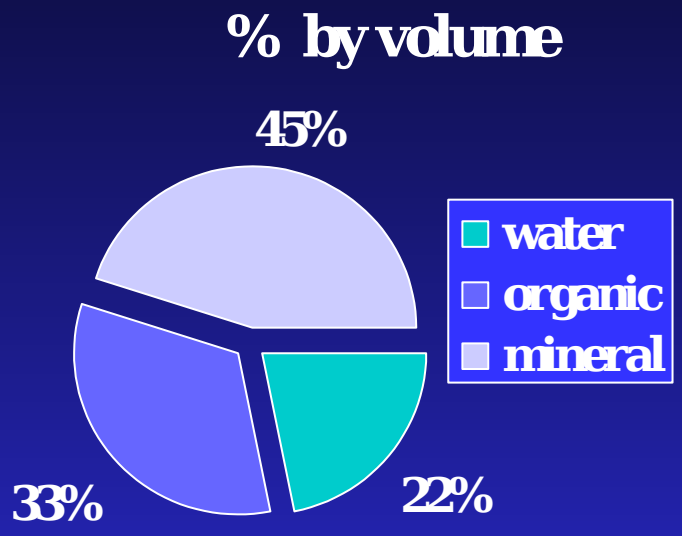
Enamel and Dentin Adhesion

Adhesion to Enamel

- Protection from moisture and saliva crucial to longevity of bond--

- Rubber dam isolation when at all possible

Dentin



- Inorganic component is heterogeneous, peritubular and intertubular dentin
- Low surface free energy - wets less easily

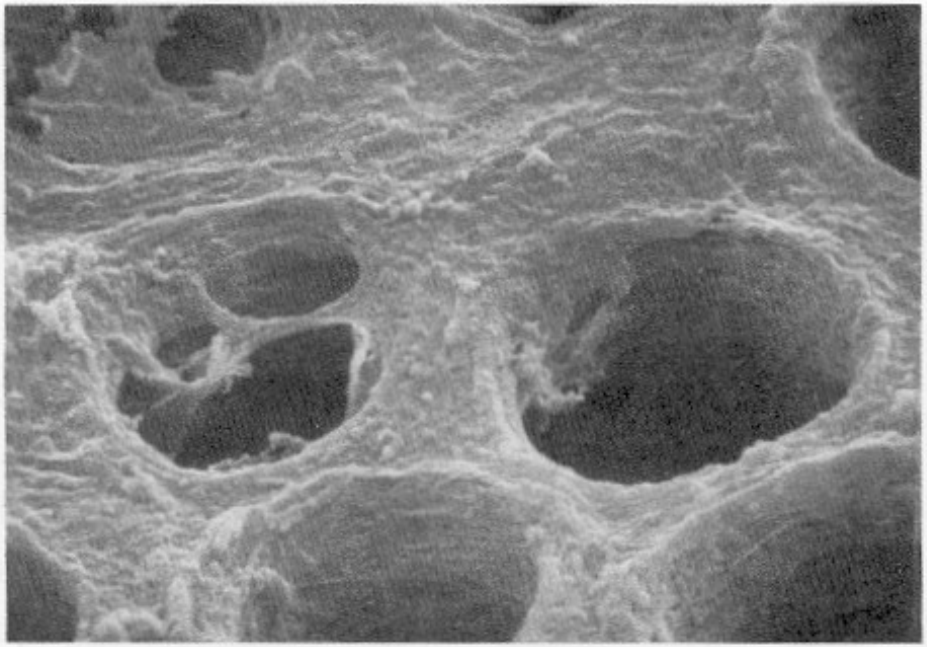


Fig. 5-6 Scanning electron micrograph (SEM) showing the effects of phosphoric acid etching of dentin. The smear layer is removed and the dentinal tubules are opened. *(Courtesy Byoung Suh.)*

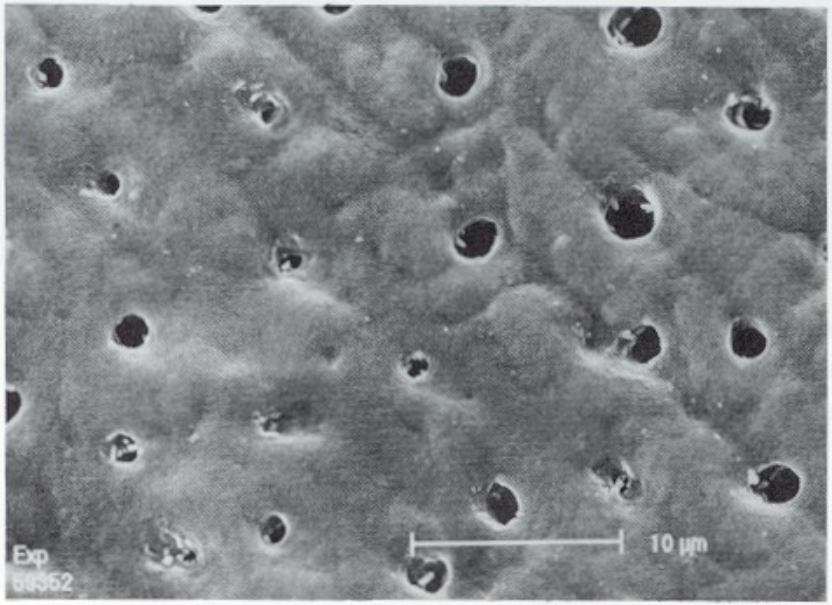


Fig. 5-43 A, Application of the conditioner to the surface; B, for a 30-second period. C, Dentin treated with conditioner solution. *(C from Kubo S et al: Principles and mechanisms of bonding with dentin adhesive materials, J Esthet Dent 3(2):62, 1991.)*

Enamel and Dentin Adhesion

- Dentinal tubules

Composition of Tooth Structure

	pulp	DEJ
diameter (microns)	2.5	0.8
number	45,000	20,000
tubular surface area	25%	3%

Enamel and Dentin Adhesion

Smear Layer

Enamel and Dentin Adhesion

- Tooth surface instrumented with a rotary or manual instrument
- Composed of:
  - pulverized hydroxyapatite
  - altered collagen
  - bacteria
  - saliva

Smear Layer

Enamel and Dentin Adhesion

- Various acids used

Conditioning of Dentin

  - phosphoric
  - citric
  - maleic
  - nitric

Enamel and Dentin Adhesion

- Conditioning of Dentin
  - Removes smear layer

- Exposes a microporous scaffold of collagen fibrils increasing the microporosity of intertubular dentin

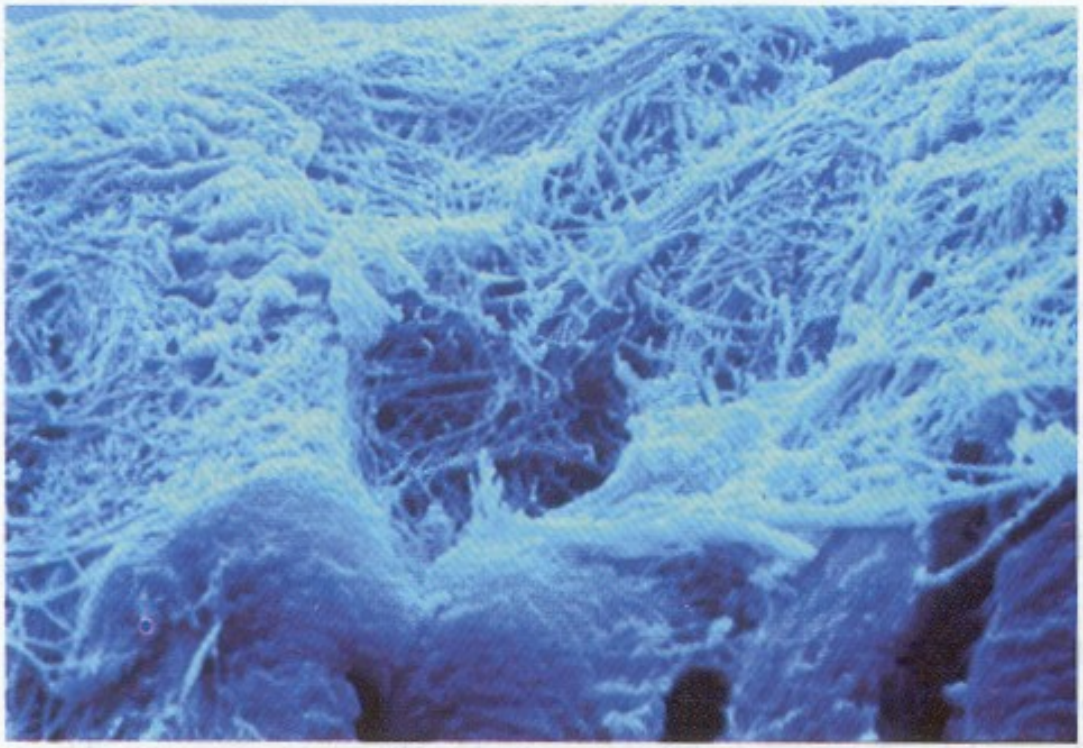


Figure 1. Collagen fibers exposed after etching dentin (scanning electron microscopy X5000; reprinted with permission of P.N. Mason).

Enamel and Dentin Adhesion

- Drying the dentin will produce a relatively impermeable amorphous layer
  - denatured collagen
  - collapse of collagen layer
- Must remain <u>moist</u> to resist this impermeable layer

Conditioning of Dentin

Enamel and Dentin Adhesion

- Clinically, a shiny, hydrated surface is seen
- Pooled moisture should be removed by blotting
- Dry dentin should be remoistened with a wet cotton pledget

Enamel and Dentin Adhesion

- Polymerization shrinkage
  - 2.9 to 7.1% by volume
  - contraction gap
  - 17-20 MPa bond strength to overcome

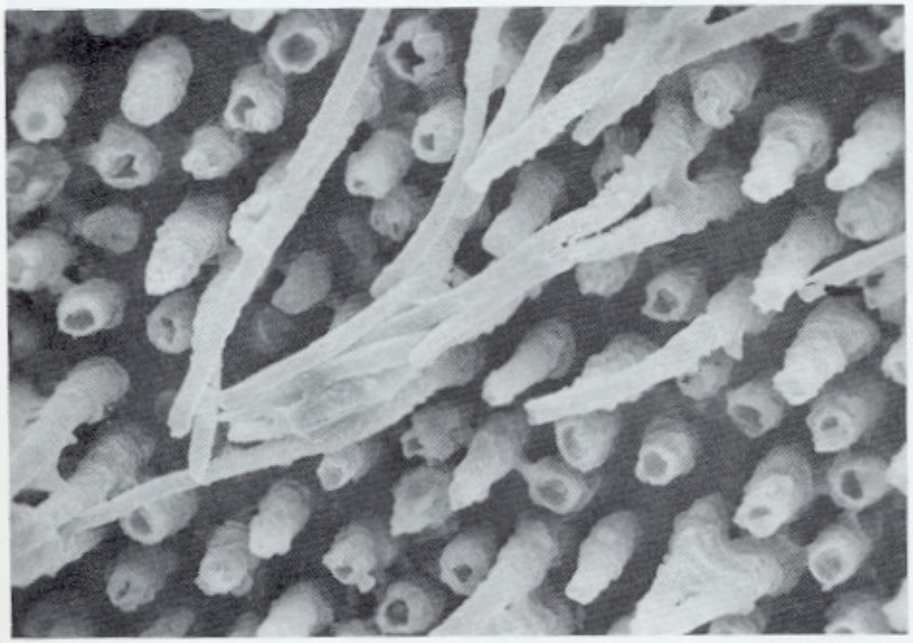


Fig. 5-12 SEM of the resin surface after dissolution of the dentin by means of hydrochloric acid. The resin tags projecting into the dentinal tubules are hollow. *(Courtesy Byoung Suh.)*

Clinical technique: Direct anterior restorations

1. select the shade before the tooth is becomes dehydrated
    a. Select shade from tab in a variety of lights
    b. Apply restorative/ Do not etch
    c. Polymerize and evaluate the shade, remove with a scaler or explorer
2. Place the rubber dam
3. Prewedge if contact may be a problem

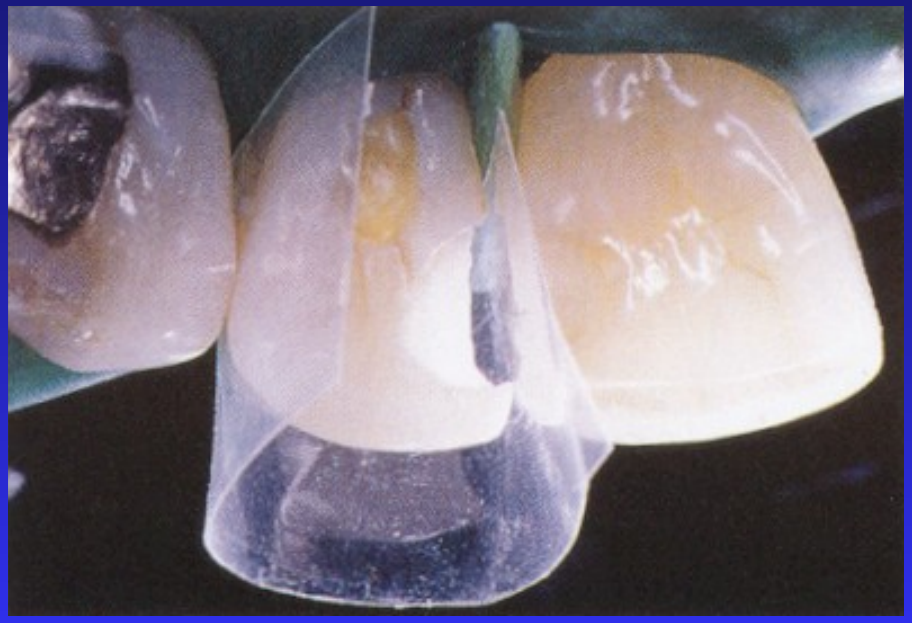
4. Place a base or liner to protect the pulp as directed
5. Etch enamel and exposed dentin protecting the adjacent tooth with a matrix strip
6. Place primer and adhesive according to the manufacturers instructions
7. Light cure as indicated
8. Place a clear plastic matrix that will approximate the final form of the restoration, utilize a wedge as necessary

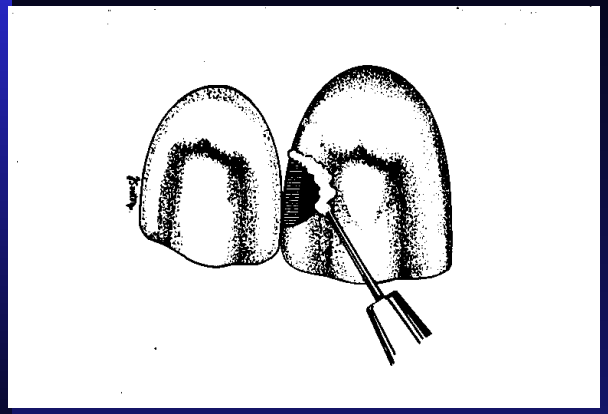
9. Place resin restorative material in increments no larger than 2 mm, light cure
   a. Air inhibited layer stays reactive
   b. Insert into line angles and cure
10. Place additional increments until the cavity is filled to contour, light cure IAW manufacturers instructions
11. Remove the wedge and matrix look for voids, add composite if indicated
12. Remove gingival flash with a #12 Bard Parker blade

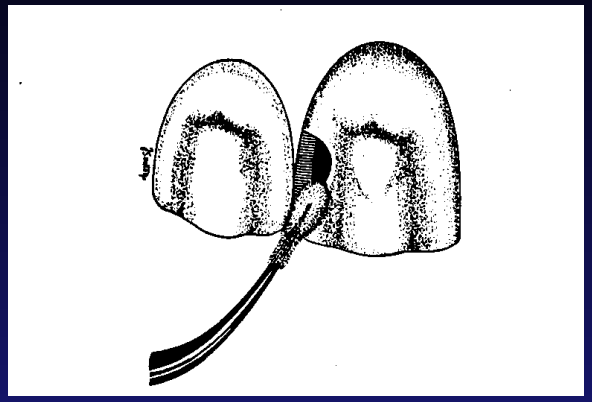
13. Remove flash from other margins and contour the restoration with a finishing bur/diamond/ or abrasive disk
14. Remove the rubber dam
15. Acid etch the surface
16. Apply Fortify or other unfilled resin, light cure after protecting the contact area.
17. Adjust the occlusion

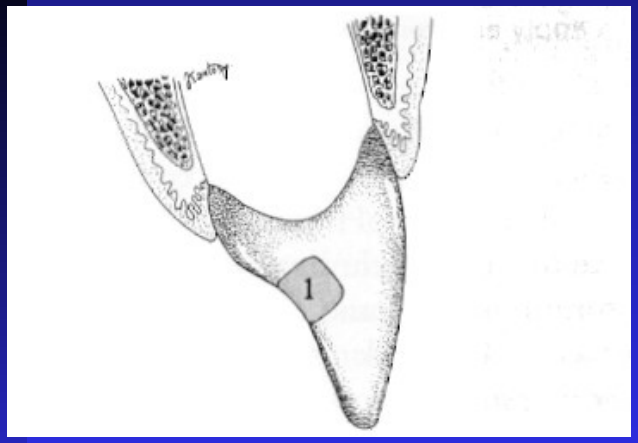
Kerr Point 4 “optimized particl

composite





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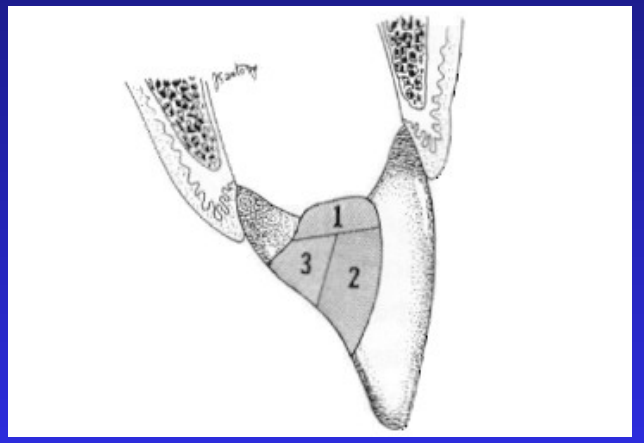
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